

**COMMON MURRE COLONY SURVEYS, WASHINGTON ISLANDS  
NATIONAL WILDLIFE REFUGE, 1997-1998**

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## INTRODUCTION

Washington Common Murre colonies on National Wildlife Refuges have been surveyed annually since 1979. The data show that, although the species was relatively abundant on offshore rocks and islands prior to 1983, murre colony attendance along the Washington outer coast refuge colonies declined severely with the strong 1983 El Niño event (Wilson 1991). Oil spills, drowning by gill nets, Navy bombing of breeding islands, and El Niños have been suspected as causes for the lack of recovery to pre-1983 levels. The Common Murre was the most frequent victim of several oil spills, including the recent Tenyo Maru spill that occurred off the entrance of the Strait of Juan de Fuca. In order to provide needed additional information on the variability of Washington Common Murre colony attendance and breeding chronology, additional murre colony surveys were added starting in 1994. During 1995-1997 three additional surveys were funded each year with Tenyo Maru Oil Spill Restoration moneys. Because Tenyo Maru funds were not available in 1998, the U.S. Fish and Wildlife Service Regional Office, Division of Migratory Birds, provided funds for two additional surveys. This report summarizes the findings of murre colony surveys along the Washington coast for the 1997 and 1998 breeding seasons.

## METHODS

Refuge murre colonies were surveyed with a Hughes 500D helicopter, chartered from Flywright Helicopters (Federal Way) on June 20, July 10, July 17 and July 23 in 1997. In 1998 a Bell 206 helicopter from Classic Helicopters (Seattle) was used for the surveys on June 16, July 6, and July 15. The passenger side door was removed for the surveys. While hovering around or over the colonies at an altitude of 70-250 m the colonies were photographed with a

Canon EOS A2 35 mm camera equipped with a Canon EF 70-200 mm f/2.8 L lens. Film was Kodak Ektachrome 400 ASA Elite. The colonies were surveyed between 09:00 and 14:00 hrs. The number of murres were estimated by counting the number of birds from the slides. For this purpose the transparencies were projected on to a paper flip chart. Small groups of murres (<30) were circled with a blue marker and then counted with a tally counter. This was repeated until the entire colony was counted. When murres were densely packed, or when the resolution of the slides was poor so that individual murres were impossible to distinguish, the number of birds within the small circled groups were estimated as well as possible. This method is identical to the one used by this author to estimate murres on the Washington coast during 1979-1982, and during 1987 when they were more abundant. The original slides are on file at the Washington Maritime Refugees office in Port Angeles. To provide some documentation of sea surface temperatures along the Washington outer coast, along with an interpretation of how these data relate to El Niño, I have provided in Appendix 1, copies of the 1997 and 1998 monthly El Niño advisories, produced by the National Marine Fisheries Service.

## RESULTS AND DISCUSSION

The 1997 and 1998 refuge colony surveys reflect prolonged El Niño conditions off the Washington coast. Warm surface water was recorded along the U.S. West Coast during much of 1997 and 1998 (see Appendix 1), and this El Niño was publicized as one of the strongest in several decades. The average number of murres counted during the surveys dropped from 6606 birds in 1996 to 3443 birds in 1997 and increased again to 5781 birds in 1998. Although this El Niño episode was more prolonged than the three previous events, in terms of numbers of

murre attending refuge colonies in Washington, the effect of the 1997/1998 event was more moderate (see Wilson 1991).

There was considerable variation in murre colony attendance patterns among the refuge colonies. At Big Stack at Point Grenville, murres increased during 1994-1996 with a peak count of 1205 birds in 1996. This colony was only slightly depressed in 1997 (Table 1) and produced young (Chris Thompson pers. com.). In 1998 the number of birds using this rock increased 151% over three similarly timed surveys in 1997 (Table 2) and between 5 and 10 chicks were observed during the 7-15-98 aerial survey. The 2035 birds counted on 6-16-98 is the highest count ever recorded for this colony. Carroll Island also increased during the pre-El Niño years of 1994-1996, and continued to increase through 1997-1998 attaining the highest count ever recorded of 3610 murres (Table 2). On the other hand, the Quillayute Needles group (Table Rock, Huntington Island, Cakesosta, and rocks 357/358) were totally deserted during three of the four surveys in 1997 (Table 1), although 1800 birds were loosely sitting around on these colonies on 7-23-97. Murres continued to avoid these colonies during 1998, as only about 10% of the numbers recorded during three similarly timed surveys in 1996 were seen there in 1998.

Aerial survey data collected over the past five years suggest that Washington murres using refuge colonies may be increasing. In order to assess future trends adequately, multiple aerial surveys need to be continued at current levels.

#### ACKNOWLEDGMENTS

I wish to thank the TMOS trustees for funding three of the four 1997 surveys, and the U.S. Fish and Wildlife Service Regional Office, Division of Migratory Birds, in particular Tara

Zimmerman, for securing funds for two additional surveys in 1998. Nisqually National Wildlife Refuge Complex as always supported this work and paid for the annual outer coast seabird survey which contributed to this report.

#### LITERATURE CITED

Wilson, U. W. 1991. Responses of three seabird species to El Niño events and other warm episodes on the Washington coast, 1979-1990. *Condor* 93:853-858.

Table 1

COMMON MURRE COLONY SURVEYS, WASHINGTON ISLANDS NATIONAL  
WILDLIFE REFUGE, 1997  
(No. of birds)

Isl. No.	Island Name	Survey Dates			
		6-20	7-10	7-17	7-23
586	Erin	0	0	0	0
585	Erin's Bride	0	0	45	0
575	Grenville Arch	0	0	0	15
570	Big Stack	885	485	705	605
529	Willoughby Isl.	0	0	0	0
531	Split Rock	0	0	75	0
483	Destruction Isl.	0	0	0	0
458	Middle Rock	0	0	0	0
409	Rounded Isl.	0	45	45	85
363	Table Rock	0	0	0	85
361A	Cakesosta	0	0	0	390
361	Huntington Isl.	2	0	0	1325
357/358	No Name	0	0	0	0
333	Gunsight Rock	75	65	135	35
332	Petrel Isl.	0	0	0	0
256	Jagged Isl.	0	0	0	0
269	Carroll Pillar	250	60	20	0
262	Carroll Isl.	2395	1595	1425	2830
192	White Rock	80	0	15	0
Total number murres within refuge:		3687	2250	2465	5370

Table 2

COMMON MURRE COLONY SURVEYS, WASHINGTON ISLANDS NATIONAL  
WILDLIFE REFUGE, 1998  
(No. of birds)

Isl. No.	Island Name	Survey Dates		
		6-16	7-6	7-15
586	Erin	145	180	175
585	Erin's Bride	30	10	15
575	Grenville Arch	0	0	0
570	Big Stack	2035	1770	1410
529	Willoughby Isl.	45	5	0
531	Split Rock	95	285	40
483	Destruction Isl.	15	0	0
458	Middle Rock	0	0	0
409	Rounded Isl.	210	0	0
363	Table Rock	140	35	85
361A	Cakesosta	0	80	0
361	Huntington Isl.	0	570	0
357/358	No Name	55	0	5
333	Gunsight Rock	155	90	75
332	Petrel Isl.	0	0	0
256	Jagged Isl.	0	0	0
269	Carroll Pillar	65	5	0
262	Carroll Isl.	3610	2805	2945
192	White Rock	75	85	NS
Total number murres within refuge:		6675	5920	4750

NS = not surveyed

## **APPENDIX 1**

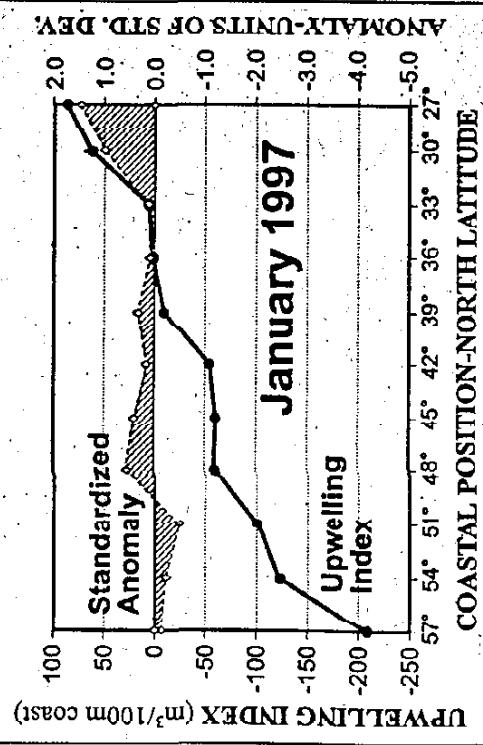
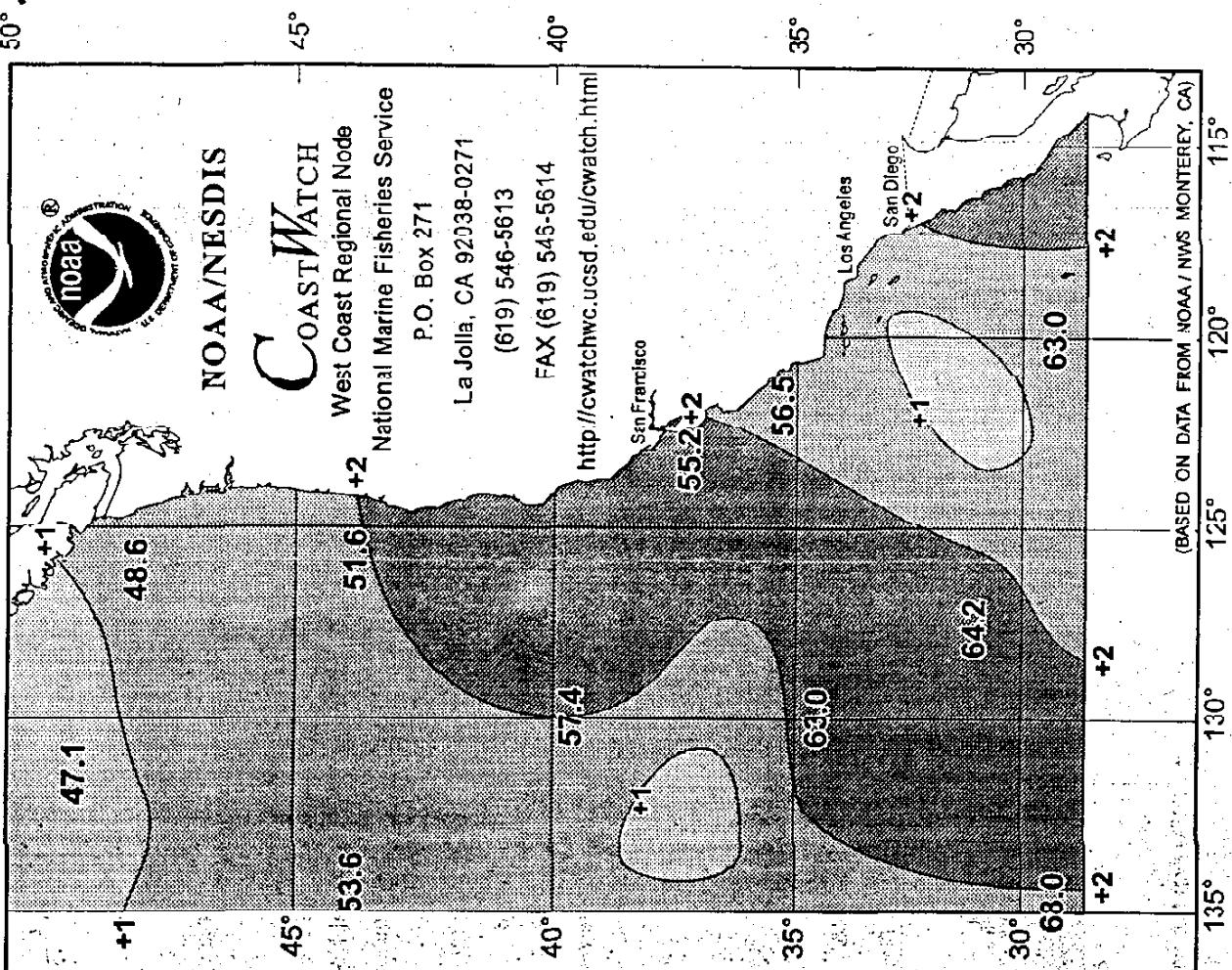
1997-1998 Monthly El Nino Watch Advisories

Produced by

National Marine Fisheries Service  
P.O. Box 271, La Jolla, CA 92038

## El Niño Watch, Advisory no. 971. Coastal Ocean Mean SST(°F) and Deviation From Normal, January 1997.

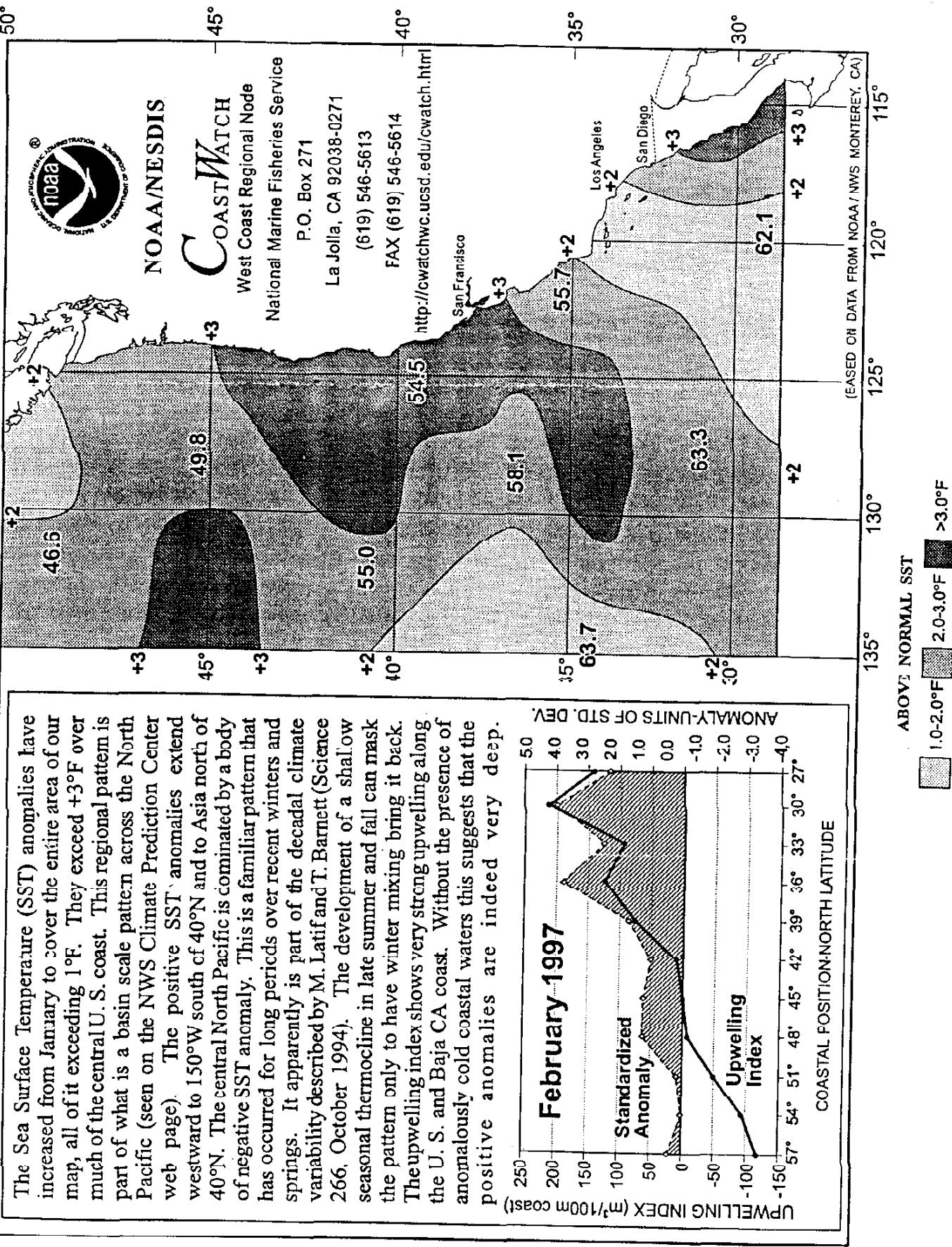
Sea surface temperatures during the month of January were above their seasonal norm for the entire area covered by our chart. Except for several small regions SST anomalies were in excess of +1.0°F. Anomalies in excess of +2.0°F were found in coastal waters from Cape Blanco to Monterey, CA and extending offshore to the southwest. This is a significant increase from the values found during December 1996 although the general pattern of anomaly contours is similar. The upwelling index for January is very close to the seasonal norm except south of the U.S.-Mexican border where it is near or slightly above one standard deviation. January is the month of maximum downwelling (and minimum upwelling) in long-term averages.



ABOVE NORMAL SST  
0-1.0°F  
1.0-2.0°F  
2.0°F >2.0°F

## El Niño Watch, Advisory no. 97-2. Coastal Ocean Mean SST(°F) and Deviation From Normal, February 1997.

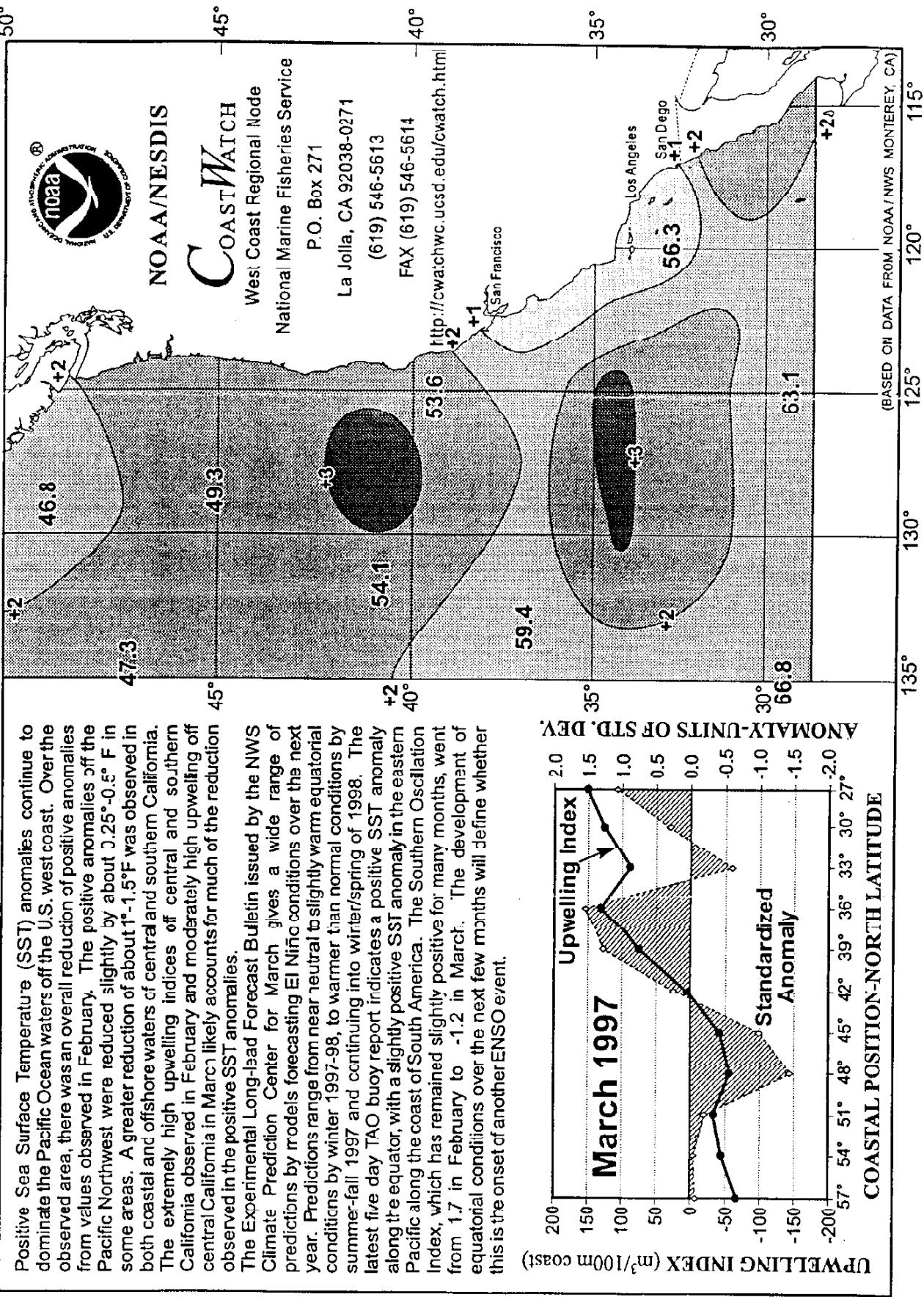
The Sea Surface Temperature (SST) anomalies have increased from January to cover the entire area of our map, all of it exceeding 1°F. They exceed +3°F over much of the central U. S. coast. This regional pattern is part of what is a basin scale pattern across the North Pacific (seen on the NWS Climate Prediction Center web page). The positive SST anomalies extend westward to 150°W south of 40°N and to Asia north of 40°N. The central North Pacific is dominated by a body of negative SST anomaly. This is a familiar pattern that has occurred for long periods over recent winters and springs. It apparently is part of the decadal climate variability described by M. Latif and T. Barnett (Science 266, October 1994). The development of a shallow seasonal thermocline in late summer and fall can mask the pattern only to have winter mixing bring it back. The upwelling index shows very strong upwelling along the U. S. and Baja CA coast. Without the presence of anomalously cold coastal waters this suggests that the positive anomalies are indeed very deep.



## El Niño Watch, Advisory no. 97-3. Coastal Ocean Mean SST(°F) and Deviation From Normal, March 1997.

Positive Sea Surface Temperature (SST) anomalies continue to dominate the Pacific Ocean waters off the U.S. west coast. Over the observed area, there was an overall reduction of positive anomalies from values observed in February. The positive anomalies off the Pacific Northwest were reduced slightly by about  $0.25^{\circ}$ - $0.5^{\circ}$  F in some areas. A greater reduction of about  $1^{\circ}$ - $1.5^{\circ}$  F was observed in both coastal and offshore waters of central and southern California. The extremely high upwelling indices of central and southern California observed in February and moderately high upwelling off central California in March likely accounts for much of the reduction observed in the positive SST anomalies.

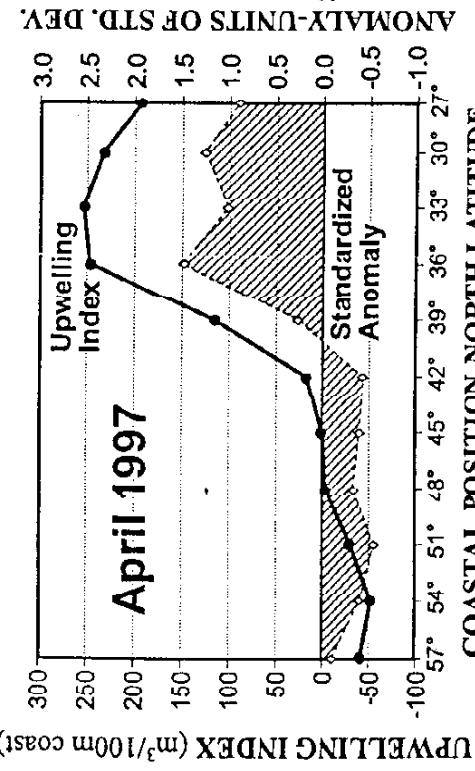
The Experimental Long-lead Forecast Bulletin issued by the NWS Climate Prediction Center for March gives a wide range of predictions by models forecasting El Niño conditions over the next year. Predictions range from near neutral to slightly warm equatorial conditions by winter 1997-98, to warmer than normal conditions by summer-fall 1997 and continuing into winter/spring of 1998. The latest five day TAO buoy report indicates a positive SST anomaly along the equator, with a slightly positive SST anomaly in the eastern Pacific along the coast of South America. The Southern Oscillation Index, which has remained slightly positive for many months, went from 1.7 in February to -1.2 in March. The development of equatorial conditions over the next few months will define whether this is the onset of another ENSO event.



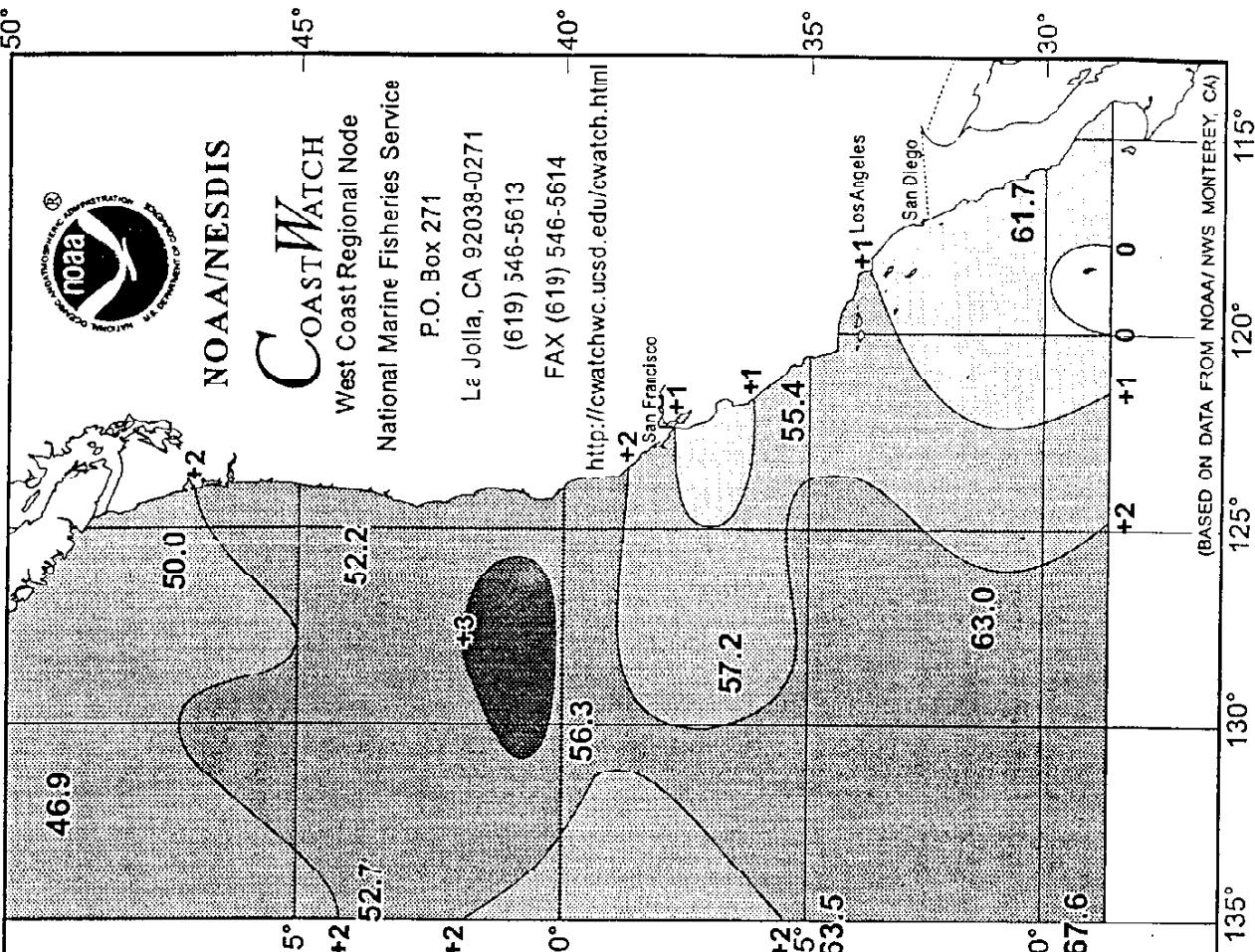
## El Niño Watch, Advisory no. 97-4. Coastal Ocean Mean SST(°F) and Deviation From Normal, April 1997.

The Sea Surface Temperature (SST) anomaly pattern in April is very similar to that observed in March. A positive SST anomaly of 1°-2°F persists off of Washington and Vancouver Island, British Columbia. A positive anomaly of 2°-3°F was observed coastally and extending offshore from Oregon to Pt. Arena, with a small region of water off Cape Mendocino which is greater than 3°F above normal. SST's in the waters greater than 300 miles offshore central and southern California were also greater than 2°F above normal. Coastal SST's off southern California and northern Baja California, Mexico were near normal, with positive anomalies less than 1°F. Slightly above normal seasonal upwelling south of Pt. Conception, as indicated in the upwelling indices from PMEL, Monterey, likely accounts for the observed decrease in SST anomalies in this region from March values.

SST data from the NOAA-TAO buoy array shows an increase in the positive SST anomalies along the equator. The Southern Oscillation Index for April was -1.3, indicating a continuation of the development of ENSO conditions at the equator. Possible influences off the U.S. west coast over the next few months will likely be the result of coastally trapped waves in the ocean moving from the equator towards the poles. Effects on local meteorological conditions will be most pronounced in the fall-winter seasons when atmospheric teleconnection patterns are stronger, should the equatorial ENSO conditions persist into those seasons.



ABOVE NORMAL SST  
 0-1.0°F    1.0-2.0°F    2.0-3.0°F    >3.0°F

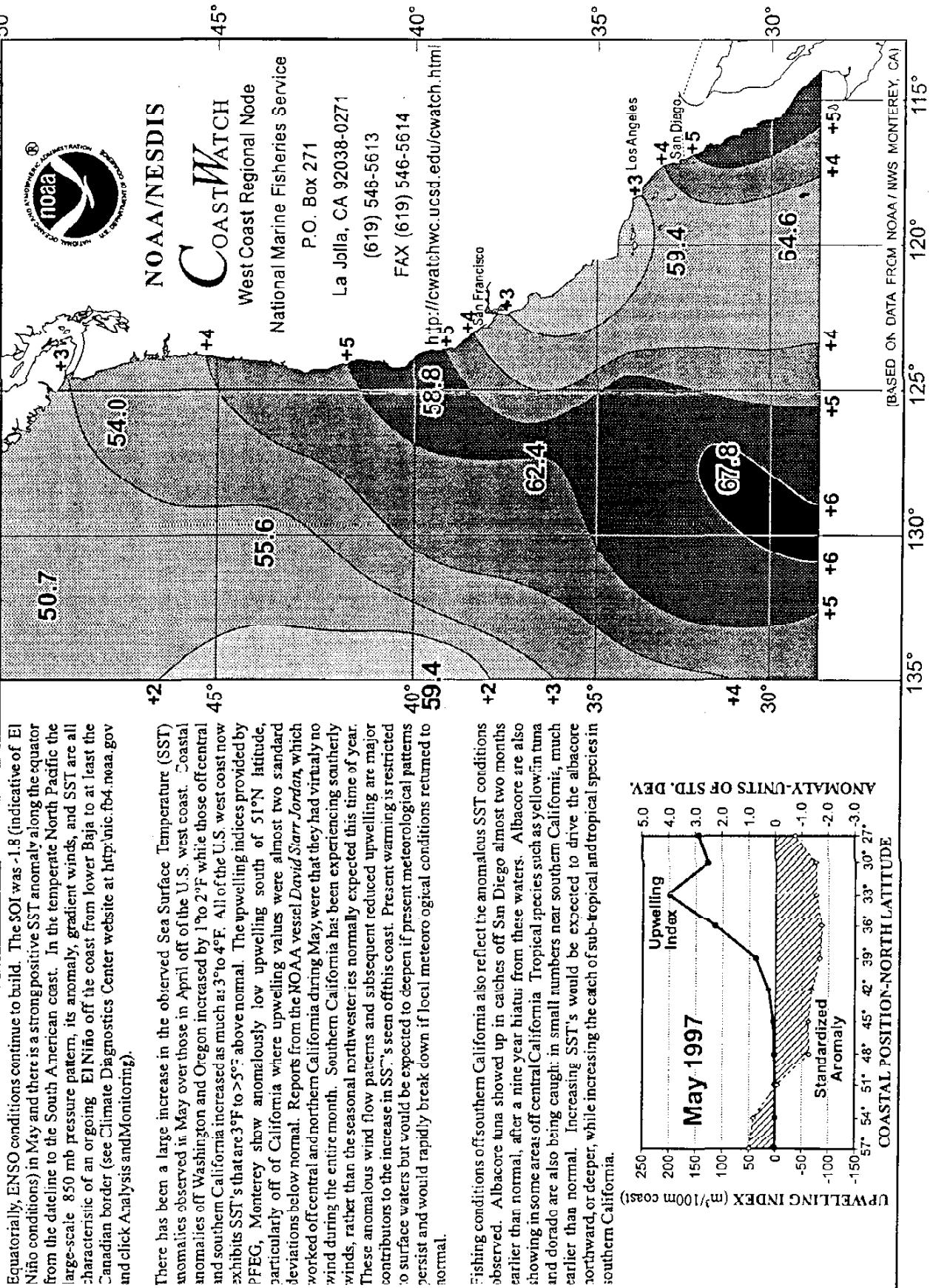


## El Niño Watch, Advisory no. 97-5. Coastal Ocean Mean SST(°F) and Deviation From Normal, May 1997.

Equatorially, ENSO conditions continue to build. The SOI was -1.8 (indicative of El Niño conditions) in May and there is a strong positive SST anomaly along the equator from the dateline to the South American coast. In the temperate North Pacific the large-scale 850 mb pressure pattern, its anomaly, gradient winds, and SST are all characteristic of an ongoing El Niño off the coast from lower Baja to at least the Canadian border (see Climate Diagnostics Center website at <http://unic.fb4.noaa.gov> and click Analysis and Monitoring).

There has been a large increase in the observed Sea Surface Temperature (SST) anomalies observed in May over those in April off of the U.S. west coast. Coastal anomalies off Washington and Oregon increased by 1° to 2°F while those off central and southern California increased as much as 3° to 4°F. All of the U.S. west coast now exhibits SST's that are 3°F to >5°F above normal. The upwelling indices provided by PEG, Monterey, show anomalously low upwelling south of 51°N latitude, particularly off of California where upwelling values were almost two standard deviations below normal. Reports from the NOAA vessel *David Starr Jordan*, which worked off central and northern California during May, were that they had virtually no wind during the entire month. Southern California has been experiencing southerly winds, rather than the seasonal northwesterlies normally expected this time of year. These anomalous wind flow patterns and subsequent reduced upwelling are major contributors to the increase in SST's seen off this coast. Present warming is restricted to surface waters but would be expected to deepen if present meteorological patterns persist and would rapidly break down if local meteorological conditions return to normal.

Fishing conditions off southern California also reflect the anomalous SST conditions observed. Albacore tuna showed up in catches off San Diego almost two months earlier than normal, after a nine year hiatus from these waters. Albacore are also showing in some areas off central California. Tropical species such as yellowfin tuna and dorado are also being caught in small numbers near southern California, much earlier than normal. Increasing SST's would be expected to drive the albacore northward, or deeper, while increasing the catch of sub-tropical and tropical species in southern California.

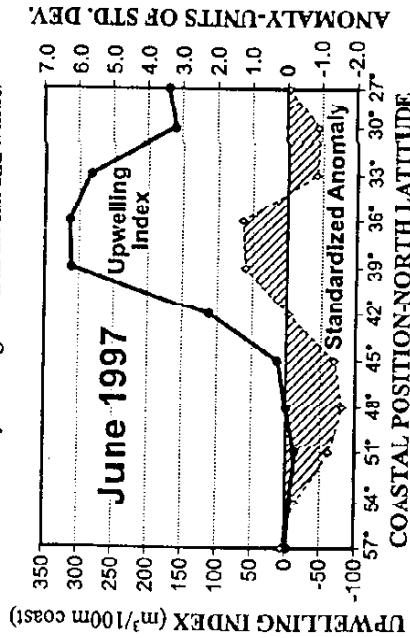
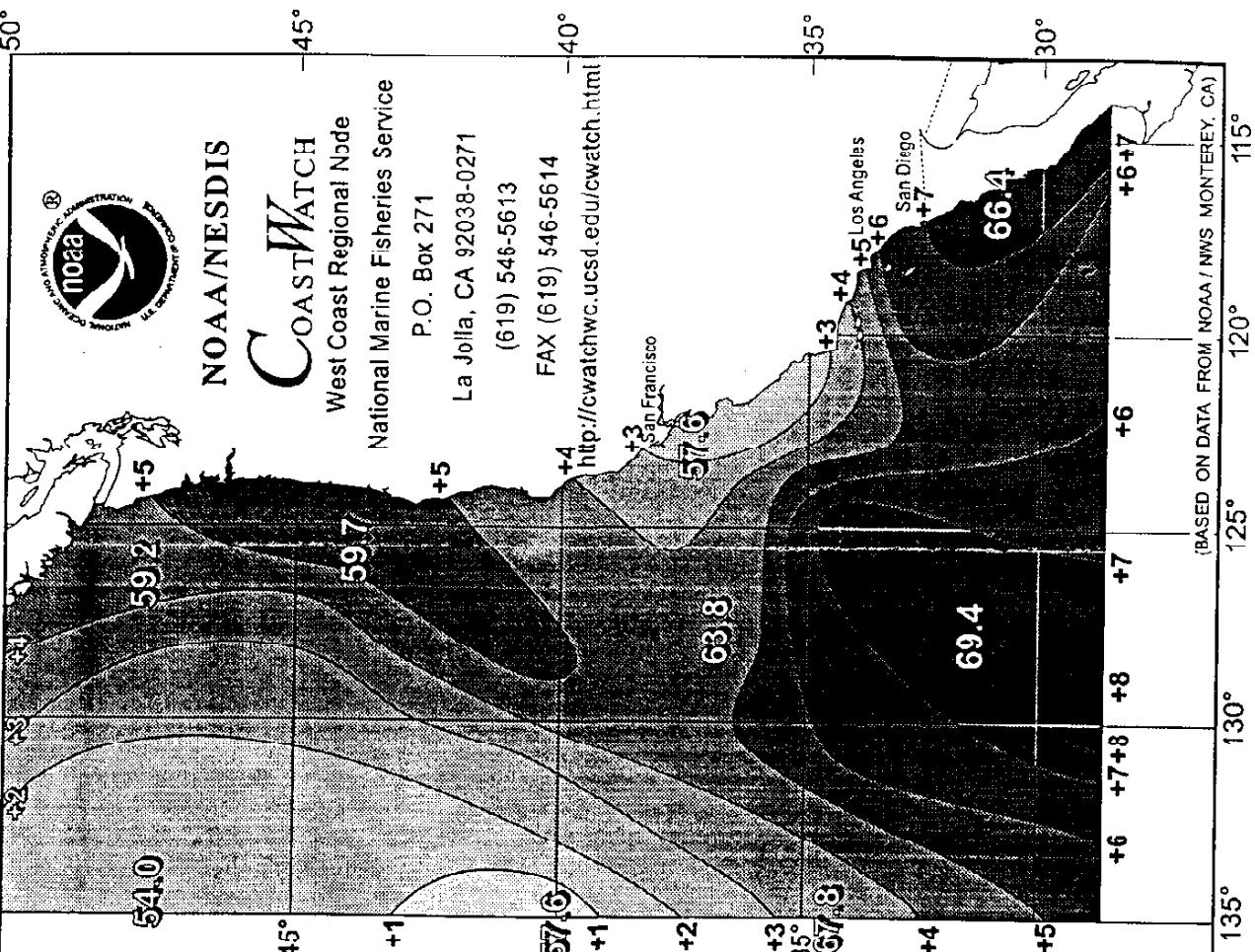


## El Niño Watch, Advisory no. 97-6. Coastal Ocean Mean SST(°F) and Deviation From Normal, June 1997.

The developing El Niño conditions in the tropics and extra-tropics continue unabated. Anomalies of sea surface temperature (SST), already at or near record levels during May, have continued to increase. The NWS Climate Prediction Center (CPC) notes that the easterly winds at the equator have collapsed and in some regions have been replaced by westerly winds. The strength of this El Niño as measured by the SST anomalies is being compared with that of 1982 which was the strongest recorded event. The CPC is predicting that this warm episode will continue through the end of the year.

SST anomalies exceed +5°F off the Pacific Northwest and +7°F off Baja California and in a large region beyond 25°W off southern California. These anomalies are approximately a 1 to 1.5°F. increase over the anomalies during May. Only in a localized region along the coast between San Francisco and Pt. Conception (34.5°N) did the anomaly remain as it was during May (slightly below +3°F). Off Cape Mendocino the anomaly decreased by 1°F. This central California region experienced above normal north-northwesterly winds during June producing a modestly high value for the upwelling index. The upwelling only held the average temperatures from increasing beyond their typical monthly change. Elsewhere the upwelling index shows normal or lower than normal upwelling.

Preliminary information from a CalCOFI survey presently underway off southern California (July 8; only two station lines at this time) indicate that the wind and weather have picked up over conditions that had prevailed in June. The warm surface layer continues but at lesser positive SST anomalies. The survey finds the nutricline to be shallow and chlorophyll values to be moderately high. As evidenced during other El Niño events there is a potential for a period of fluctuation or even reversal in warm surface conditions during summer months followed by a strong return in the fall and winter.

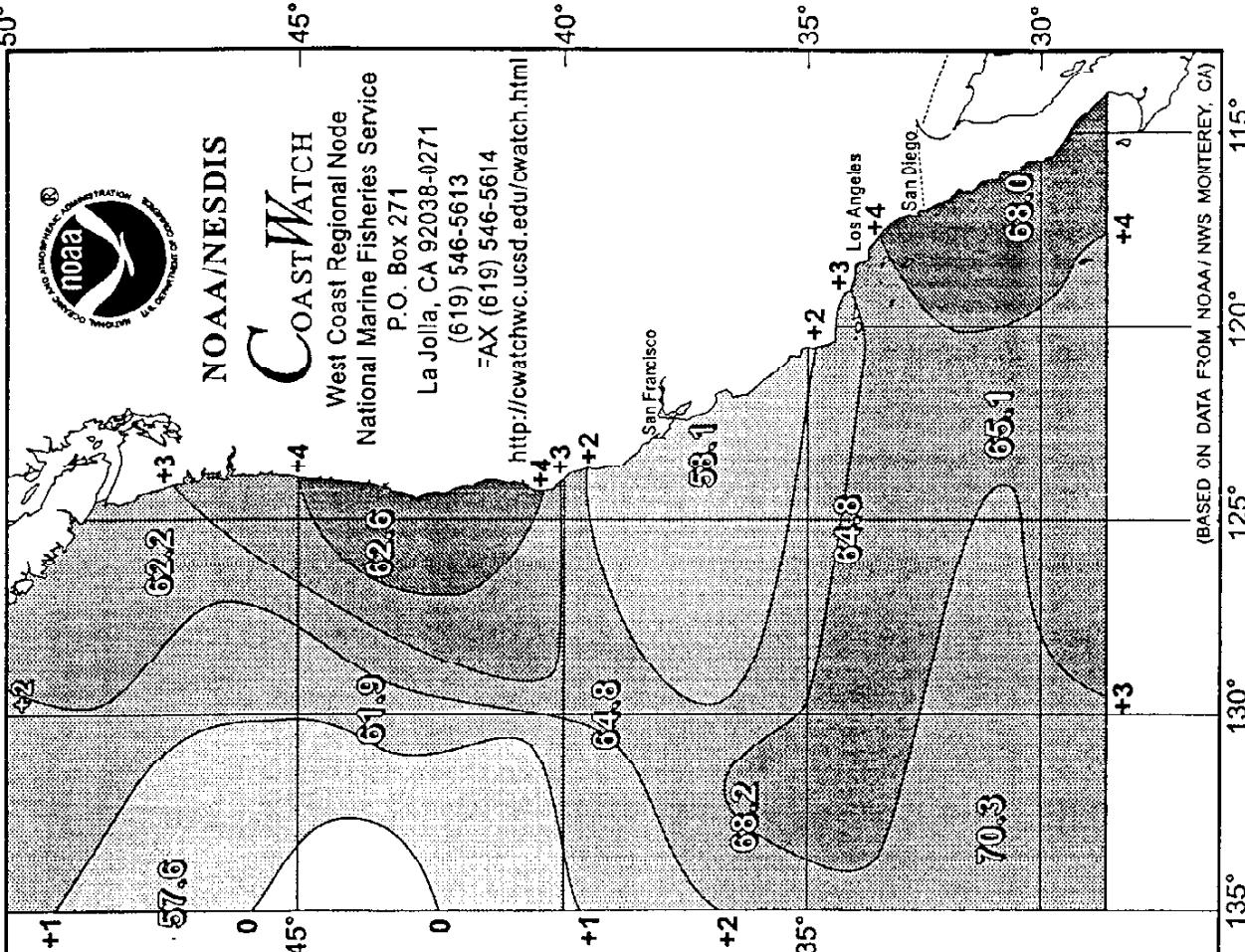
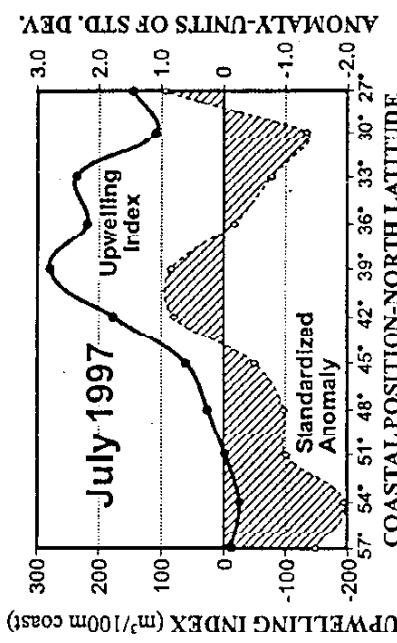


## El Niño Watch, Advisory no. 97-7. Coastal Ocean Mean SST(°F) and Deviation From Normal, July 1997.

Strong positive SST anomalies along the equator increased during July across the entire Pacific. The highest anomaly of greater than 4°C (7.2°F) occurs along the coast of Ecuador. The Southern Oscillation Index(SOI) in July was -1.0, the fifth consecutive month of a negative index. The NWS Climate Prediction Center expects that this event will continue through the end of the year and into early next year and will be one of the strongest ENSO events recorded in the past 50 years.

The extremely high sea surface temperature anomalies observed in June off the U.S. west coast decreased in July by 1°-2°F off Pacific Northwest and central California, and by 2°-3°F off of southern California. The July anomaly in 45° coastal waters off Oregon and Washington was 3°-4°F above the long-term mean while waters 300 miles offshore were near normal. Off central California, coastal waters were slightly less than 2°F above normal. Southern California SSTs which had been 6°-7°F above normal in June were 4°F above normal in July. Much of the decrease in SST anomalies observed along the California coast was likely caused by persistent northwesterly winds and normal upwelling during July. During the July CalCOFI cruise the warm surface layer of southern California had been observed to be very shallow, with decreasing SST anomalies as steady winds mixed the surface layer.

Coastal waters off southern California in early August were 70°-72°F and the abalone tuna which had been within 50-60 miles of San Diego the past several weeks are now concentrated 120 miles offshore in cooler water. Near shore, large numbers of yellowtail and dorado (mahi-mahi) with a few tropical yellowfin and skipjack tuna are showing up in the sport catch. Large numbers of yellowfin tuna have been observed off central Baja California, Mexico and could move up into southern California waters with the warmer SSTs observed. In addition, large numbers of striped marlin and mako sharks have been observed in the southern California Bight the past few weeks.

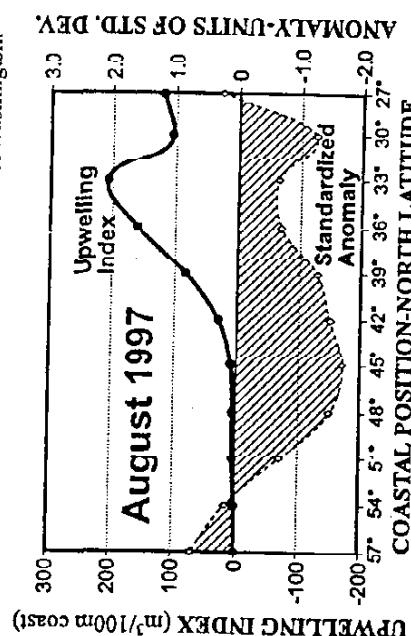
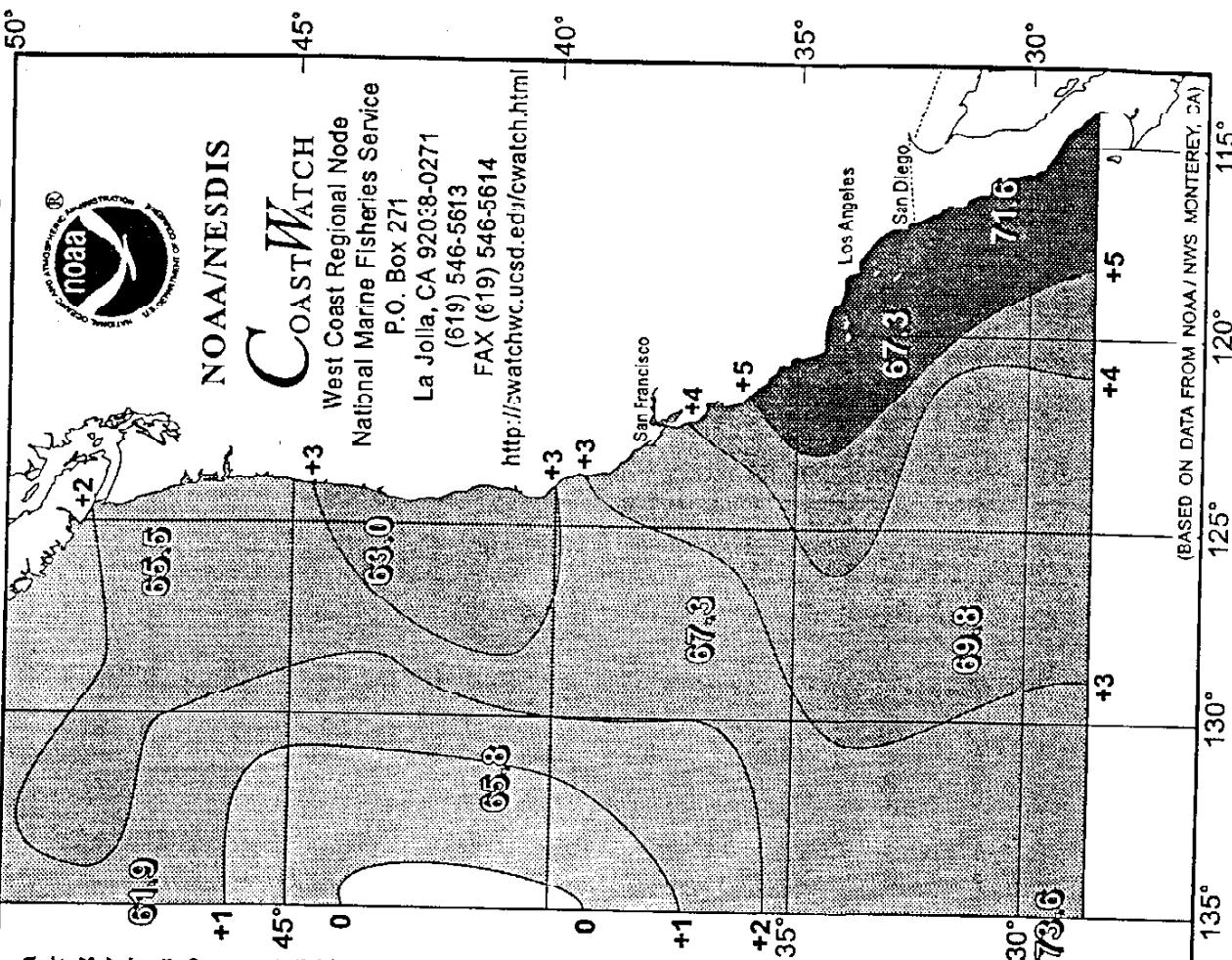


## El Niño Watch, Advisory no. 97-8. Coastal Ocean Mean SST(°F) and Deviation From Normal, August 1997.

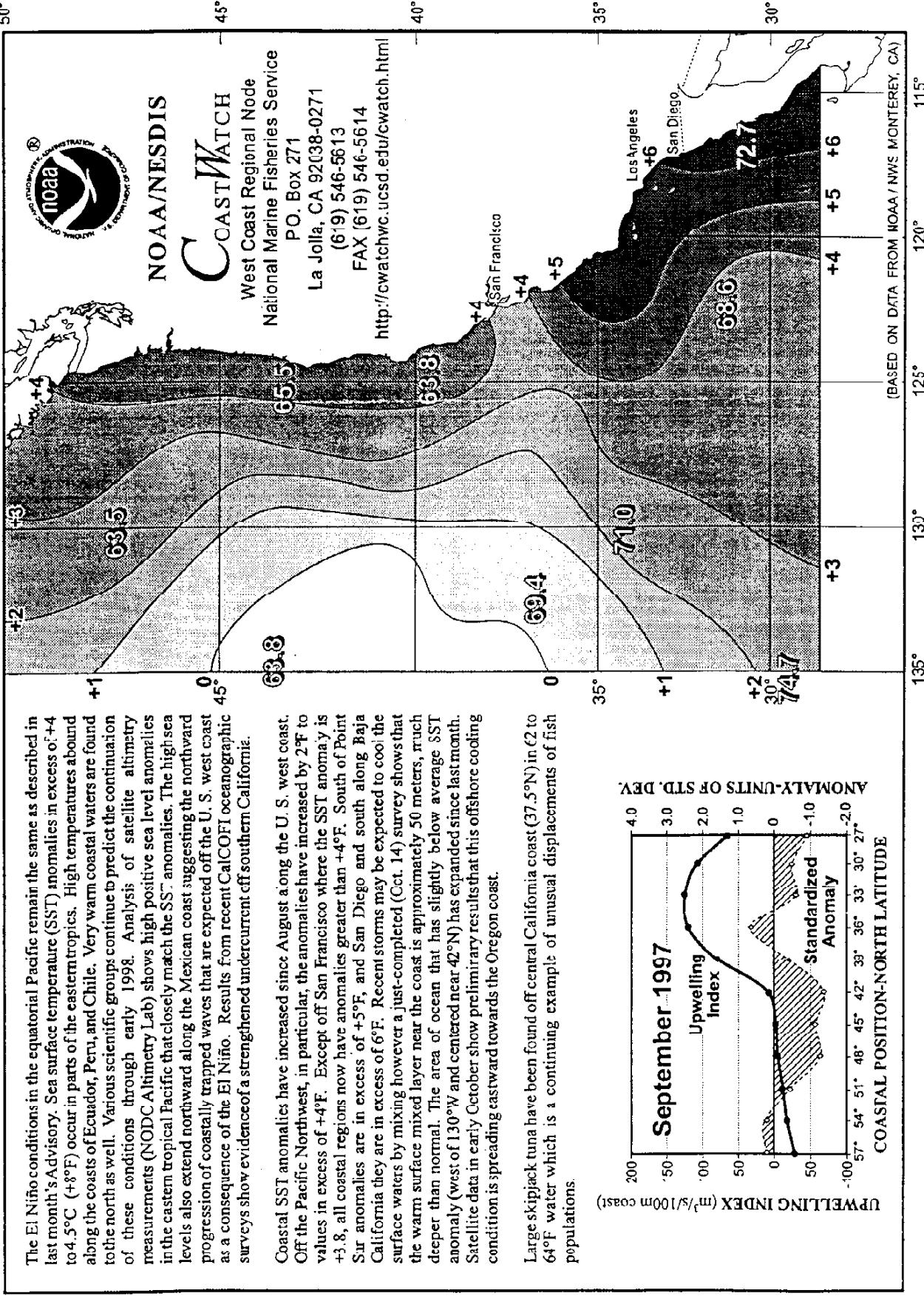
El Niño type conditions continued along the equator in the central and eastern Pacific, with sea surface temperature (SST) anomalies of +1°F to greater than +4°F (8.0°F) observed from the dateline to the South American coast during August. According to the Climate Prediction Center/NCEP Diagnostic Advisory 97/8, some areas in the eastern equatorial Pacific had the highest August SST anomalies observed in 50 years. The Southern Oscillation Index in August was -2.1, the sixth consecutive month of a negative index indicative of an El Niño event. Models continue to predict a continuation of this event into early 1998.

Positive SST anomalies were observed along the entire U.S. west coast in August. Off the Pacific northwest, coastal SST anomalies dropped about 1°F from values observed in July. SST's were 2°F above normal off Oregon and Washington and 3°F above normal off northern California. A shift in windflow patterns off the Pacific northwest from northwesterly to a more westerly flow reduced seasonal upwelling and also may have pushed cooler offshore waters closer to shore. Central and southern California coastal waters had a slight increase of about 1°F in the positive anomalies observed in August over July values. Again, reduced upwelling was observed and likely contributed to the increased warming of the sea surface. SST's were 3°F above normal off central California and over 5°F above normal from above Pt. Conception to offshore Baja California, Mexico.

Coastal SST's off southern California have been reported as high as 77°F in August and sport fisheries have reflected the tropical nature of water conditions. High numbers of yellowtail were caught in August, as were dorado (mahi-mahi). Yellowfin and skipjack tuna were also landed from upper Baja California, Mexico northward around the channel islands. Some catches of bullet tuna have also been reported off southern California. Highly unusual are reports of dorado being caught off San Francisco and a marlin landed off the state of Washington.



## El Niño Watch, Advisory no. 97-9. Coastal Ocean Mean SST (°F) and Deviation From Normal, September 1997.



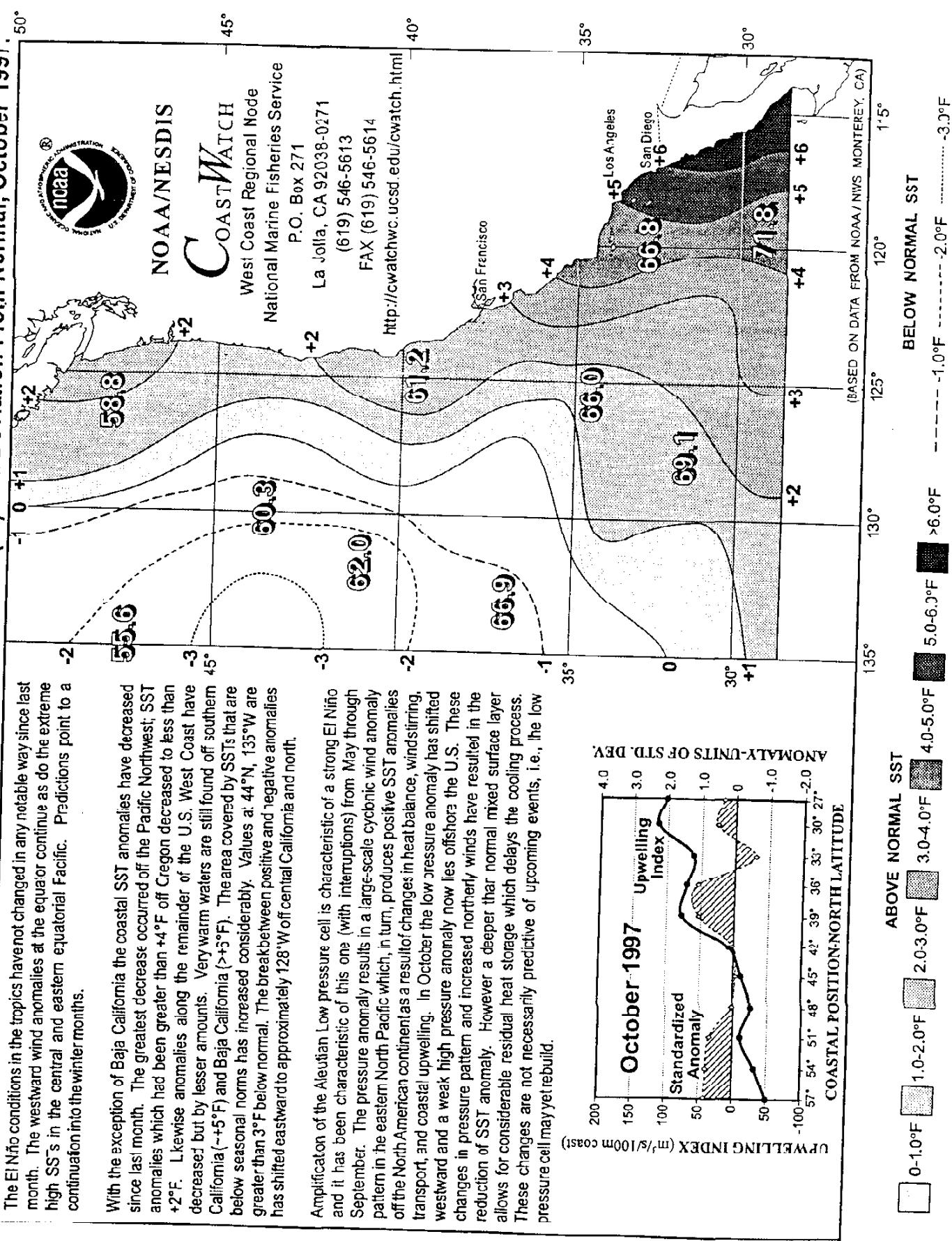
0-1.0°F    1.0-2.0°F    2.0-3.0°F    3.0-4.0°F    4.0-5.0°F    5.0-6.0°F    >6.0°F

## El Niño Watch, Advisory no. 97-10. Coastal Ocean Mean SST(°F) and Deviation From Normal, October 1997.

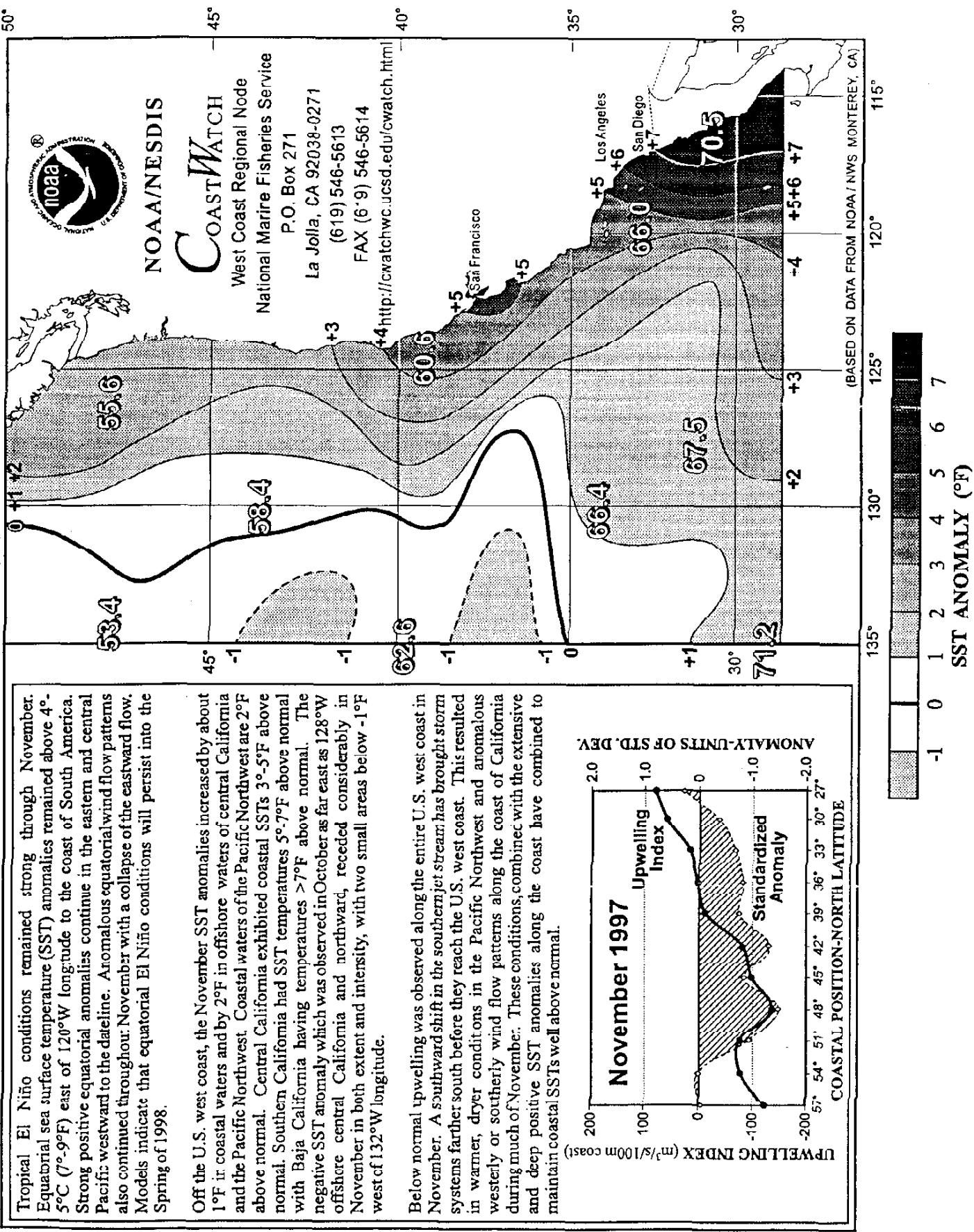
The El Niño conditions in the tropics have not changed in any notable way since last month. The westward wind anomalies at the equator continue as do the extreme high SST's in the central and eastern equatorial Pacific. Predictions point to a continuation into the winter months.

With the exception of Baja California the coastal SST anomalies have decreased since last month. The greatest decrease occurred off the Pacific Northwest; SST anomalies which had been greater than +4°F off Oregon decreased to less than +2°F. Likewise anomalies along the remainder of the U.S. West Coast have decreased but by lesser amounts. Very warm waters are still found off southern California (~+5°F) and Baja California (>+5°F). The area covered by SSTs that are below seasonal norms has increased considerably. Values at 44°N, 135°W are greater than 3°F below normal. The break between positive and negative anomalies has shifted eastward to approximately 128°W off central California and north.

Amplification of the Aleutian Low pressure cell is characteristic of a strong El Niño and it has been characteristic of this one (with interruptions) from May through September. The pressure anomaly results in a large-scale cyclonic wind anomaly pattern in the eastern North Pacific which, in turn, produces positive SST anomalies off the North American continent as a result of changes in heat balance, windstirring, transport, and coastal upwelling. In October the low pressure anomaly has shifted westward and a weak high pressure anomaly now lies offshore the U.S. These changes in pressure pattern and increased northerly winds have resulted in the reduction of SST anomaly. However a deeper than normal mixed surface layer allows for considerable residual heat storage which delays the cooling process. These changes are not necessarily predictive of upcoming events, i.e., the low pressure cell may yet rebuild.



## El Niño Watch, Advisory no. 97-11. Coastal Ocean Mean SST(°F) and Deviation From Normal, November 1997.



## El Niño Watch, Advisory no. 97-12. Coastal Ocean Mean SST(°F) and Deviation From Normal, December 1997.

